repairs, chimney-sweeping, gas, and water charges should be liquidated by the landlord or proprietary, and added to the rent. Fire-proof houses would not require insurance.

It is conceived, that houses such as these might be let on remunerative terms by landlords, or companies undertaking their construction, and bearing the charges which I have above enumerated, and yet at rents as low or lower than what is now charged for dwellings miserably insufficient. They would be handsome as to their exteriors, and admit of every decency and propriety as regards the interior.

I am, Sir, &c.,

HENRY M'CORMAC, M.D.

Belfast, Sept. 15.

SUGGESTIONS FOR THE IMPROVEMENT OF SEWERS.

BY JOHN PHILLIPS.

"Devouring pestilence hangs in our air."—Rich. II.

THE healthful condition of every population is dependant, in a very great measure, upon good and efficient sewerage, and from the manner in which this question is being taken up, as well as from the publicity which has already been given to it, I consider it behoves every one who is acquainted with the subject to give attention to its improvement and amelioration. Therefore, taking this view of the case, and believing that many great and glaring evils require speedy and effectual remedy, I am induced to offer the following observations and propositions relative thereto.

During the last century science and art have made more than rapid strides, and almost every subject has received great and important improvements; but it is manifest that the "science of sewerage" (certainly with some exceptions) is nearly in the same unimproved, drawling, and backward state that it was a century ago. It is presumed, therefore, that it can be no less the desire of the proper authorities to adopt, than it is the duty of *persons* to suggest improvements; and I hope and trust that the time is not far distant when good, sound, and practical suggestions, having for their object the general improvement of sewers will receive that due and proper consideration, from whatever source those propositions may emanate, that its nature, magnitude, and importance demands.

It has long been a subject of grievous complaint, and justly so too, that filthy and malignant streams of air are continually emanating from the gully-holes in the streets. Now, the cause of much of the stench and effluvia from sewers is owing to their extremely large sizes, the inefficiency of their form, and the sluggishness of their falls. For the quantity of water which is usually discharged into them, is so very small when compared with their magnitude, that it becomes extended and spread over a wide surface; and the height of the streams being, therefore, very diminutive, their motions are generally so feeble and slow, that they have not sufficient velocity and power to raise up and carry off the soil, consequently the matter becomes deposited upon their channels; and, as it decomposes, it generates foul and malignant gases, which, by escaping through the untrapped gullies and private drains into the streets and houses, contaminate the surrounding atmosphere with nauseous and pestilential impurities.

It is extremely desirable that this great and growing nuisance should be prevented if possible. Many methods have at various times been suggested accordingly, some of which are certainly very ingenious, but it would appear that they more or less bear the impress of impracticability. Streams of air must be continually allowed to pass into and out of the sewers, in order to keep them properly and efficiently ventilated; and this can only be done by direct communications or passages being made between the sewers and the atmosphere. And in consequence of proper means never having been devised for the purpose of preventing the effluvia from escaping, and at the same time maintaining the circulation of air, without the facilities afforded by the gullies and private drains, the authorities under whose care the sewers have been placed, have always had a strong aversion to the system of trapping.

But in this case, as in numerous others, prevention is a great deal better than the cure for it, and if means were adopted to prevent deposits from accumulating in sewers, the stench then, even if most of the communicating adits were left open, would be nothing compared to what it now is; and surely whenever a sewer is found to retain the matter discharged into it, one would suppose that steps would be immediately taken to impart sufficient velocity and power to the water, so that it might be able to carry off the matter, and thus prevent a recurrence of deposits and accumulations for the future.

I am not aware if it be generally known that streams of running water communicate to the air immediately contiguous to them motions which run in the same direction as the streams. That this is the case may be proved by holding a blaze of light, or any fine light substance, just above the surface of any stream. Now, if sewers were properly arranged, so that water could be continually flowing through them, much of the foul air that is produced by the decomposition of the matter would be carried off with the running water; and, therefore, it would in some measure assist their ventilation.

There are two modes which present themselves to my mind as being the best adapted for the purpose of keeping the sewers free from deposits and accumulations of matter.

The first is the well known process of damming back the water flowing down the sewer, until it accumulates to a considerable height, and then suddenly letting it off, the impetus and force of the descending stream carrying away with it all the substances discharged into the sewer, and with which it comes in contact. This method of cleansing the sewers is now, and has been for some time, in *successful* operation in the Holborn and Finsbury Commission of Sewers, and is found to be, as I understand, and which I am satisfied must be the case, from the great power and scouring action of the water thus obtained, not only a more effectual, but also a much cheaper way of removing and carrying off the deposited matter, than the ordinary dirty and antiquated method of raising it to the carriage-ways, and then carting it away, with all its attendant annoyances.

Now the old sewers, and many of the new ones also, cannot by any possibility keep themselves clean and free from deposits with the present quantity of water which is discharged into them, in consequence of their extremely large sizes, the injudicious form of their bottoms, and their inadequate falls, as before referred to; for when one of them is cleansed, the matter which is immediately afterwards discharged into it becomes deposited upon the bed (its wide, expanded border causing the liquid mass to spread), and the sewer again becomes in a short time wholly inefficient for the purpose of removing and carrying off the soil. The matter again accumulates until the private drains are prevented from acting, when the soil has again to be lifted to the carriage-ways, and this process of cleansing and recleansing must ever be continued so long as this form of sewer exists, and remains unimproved. From the filthy condition in which very many of these sewers now are, the means which *have been proved* to be highly efficacious for the purpose of keeping them clean, ought not I think to be longer delayed; and I feel assured that were the authorities *fully acquainted* with the condition of the sewers under their jurisdiction, there being whole districts where sewers are more or less choked with decomposed matter, not another day would be lost without taking advantage of so simple and ready a method of improvement.

It must, however, be admitted that the method of flushing the sewers is only an expedient to be resorted to when the sewers cannot be kept clean by the simple means of proper construction and efficient fall; I would, therefore, beg to suggest another distinct method of proceeding, which, in the end, will prevent the matter discharged into the sewers from becoming deposited upon their channels. I propose that all the secondary, or collateral sewers, those which branch out of the main lines, as also those which communicate with and discharge their contents into these secondary lines, should be *strictly examined and properly surveyed*; the relative levels throughout each of these collateral districts should also be carefully taken and laid down with a view to an improvement of their falls, and whenever improvement can be obtained, either by a re-arrangement of them so as to discharge into each other by different directions if found possible, or by their present course, it should be effected by taking out (where found practicable, and this would arise in nine cases out of ten), the present wide and flat bottoms, and putting in others of a narrow, elliptical shape, at a lower level, or at a higher, as found requisite, and at proper inclinations previously determined on; and where the old sewers are found in a bad or dilapidated condition, the interior of them should be strongly and entirely cased with good sound brickwork, taking out the old bottoms as before mentioned, and cutting away half a brick in thickness on each side, making the form of the casing either that of an egg with the narrow end downwards; or with a semicircular bottom having upright sides and a semicircular arched crown; contracting the widths of the sewers by making the brickwork one brick thick at the sides and bottoms, and half brick thick at the crowns, the whole being properly underpinned and soundly executed with good hard stocks and hydraulic mortar, whose ingredients should be well compounded; and their junctions should be formed with a quadrant, whose radius should be as long as found convenient. It should be distinctly understood that no more work should be commenced until the sizes and falls of all the sewers have been determined on, and re-arranged according to a regularly graduated scale, commencing at the lowest point of each collateral district, and following them up from time to time, either with new bottoms or casing, as they might require, until the whole of the sewers in each particular level were completed; they would then keep themselves clean, and be in a state of completeness and efficiency without either flushing or cleansing, the whole expenses of which would be saved: and I have no hesitation in saying that until either this be set about and done, or they be entirely rebuilt, there are very many lines which will never be any other than elongated and filthy reservoirs or cesspools, the matter in which will be continually contaminating the atmosphere with its deleterious products. These great evils require immediate reparation, which should not be done piecemeal, but upon a well organized system of arrangement; and if the matter be taken up, as I trust it will, the cost of putting the whole of the badly formed sewers into a state of comparative efficiency could be ascertained without great difficulty.

The practical operations of this mode of execution can be effected in a most expeditious and simple manner by the following process:—Shafts should be sunk over the sewers (say at from two to three hundred feet apart) or the present ones used where found; a gang of workmen would then commence digging out the old bottom, or cutting away the half brick at each of the side walls up to the springing of the upper arch, the rubbish being taken a head up the nearest shaft; and thus the work could be prepared ready for the bricklayers, who would put in the new work as fast as the men beyond got it ready for them; the materials should be let down from the shaft next behind, and thus the two operations would not interfere with each other. Of the practicability of this proceeding there can be no doubt, and were it adopted it would be a vast saving of expense, besides, it could be done with more despatch than the ordinary process of opening the streets and blocking up the carriage ways to the prevention of the business of the public.

Now, in order to prevent the stench and effluvia, which under the present system must necessarily rise through the gullies and drains where these are untrapped, it is desirable to purify the air in the sewers themselves before it is allowed to escape into the streets, by disengaging from it, if possible, all the impure compounds with which it is charged. And of all the propositions which have yet been put forth for that purpose, I believe the following will be found to be not only the most effectual, but the most practicable also; and if I can succeed in shewing that it is so, I should think there will be no difficulty in obtaining sanction to an experiment for the purpose of testing its efficiency.

Decomposing substances emit foul gases, which, mixing with the atmosphere, contami-

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